Annals of Clinical and Analytical Medicine
Original Research

Maternal and fetal outcomes of COVID-19 infection: A retrospective study from Istanbul, Turkey

Maternal and Fetal Outcomes of Covid-19 Infection

Narin Ece Çakmak[1], Burak Çakmak[1], Gül Özel Doğan[1], Alev Atış Aydın[2]
[1] Department of Obstetrics and Gynecology
[2] Department of Perinatology, Şişli Hamidiye Etfal Research and Training Hospital, İstanbul, Turkey

Abstract
Aim: The COVID-19 pandemic, caused by the SARS-CoV-2 virus, poses unique challenges for pregnant women due to physiological changes that make them more susceptible to infections. This retrospective study investigated the impact of COVID-19 on 632 pregnant women, including 267 with confirmed COVID-19 and 365 without, from January 2020 to August 2022. The pandemic's potential effects on maternal and fetal health raised concerns, given the unique immune alterations during pregnancy. Previous coronaviruses, SARS-CoV and MERS-CoV, share genetic similarities with SARS-CoV-2.
Material and Methods: Data from electronic medical records were collected for demographics, medical history, and outcomes. Statistical analyses compared COVID-19-positive and -negative groups using SPSS 15.0.
Results: Pregnant women with COVID-19 were older but had similar delivery modes and neonatal outcomes, including birth weight, height, Apgar scores, and mortality. Neonates born to mothers with COVID-19 in the second trimester had decreased birth height.
Discussion: While no significant differences were found in cesarean delivery rates and neonatal outcomes between groups, the study acknowledges limitations, including its retrospective nature and small sample size from a single center. Despite these limitations, the study emphasizes the importance of ongoing monitoring, vaccination, and protective measures for pregnant women during the pandemic.
In conclusion, pregnant women should be vigilant in following preventive measures, and further research is needed to comprehensively understand the impact of COVID-19 on maternal and fetal health. Healthcare providers should continue close monitoring and support for pregnant patients with COVID-19.

Keywords
Maternal, Fetal, Covid-19, Pregnancy

DOI: 10.4328/ACAM.22103 Received: 2024-01-10 Accepted: 2024-03-05 Published Online: 2024-04-29 Printed: 2024-07-01 Ann Clin Anal Med 2024;15(7):449-452
Corresponding Author: Narin Ece Çakmak, Department of Obstetrics and Gynecology, Şişli Hamidiye Etfal Research and Training Hospital, 34470, İstanbul, Turkey.
E-mail: rol.narinece@gmail.com P: +90 533 380 35 47
Corresponding Author ORCID ID: https://orcid.org/0000-0001-5497-4490
Other Authors ORCID ID: Burak Çakmak, https://orcid.org/0000-0001-8371-6183 · Gül Özel Doğan, https://orcid.org/0000-0001-9555-1128
Alev Atış Aydın, https://orcid.org/0000-0002-8504-5755
This study was approved by the Ethics Committee of Health Science University Sisli Hamidiye Etfal Research and Training Hospital (Date: 2022-10-07, No:3676)

Introduction

The COVID-19 pandemic caused by the SARS-CoV-2 virus has affected millions of people worldwide, including pregnant women starting on 2020 January 9 [1]. Pregnancy is a unique physiological state that alters the immune system and makes women more susceptible to infections. This has raised concerns about the potential impact of COVID-19 on maternal and fetal health [2].

Coronaviruses are enveloped, non-segmented, single-stranded ribonucleic acid (RNA) viruses causing diseases from common colds to severe fetal disorders. The two best-known fetal viruses are SARS-CoV, which causes severe acute respiratory syndrome (SARS), and MERS-CoV, which causes Middle East respiratory syndrome (MERS). The genome of SARS-CoV-2 shares about 80% and 50% similarity with SARS-CoV and MERS-CoV, respectively [3].

COVID-19 infection has a broad impact, from death to being asymptomatic. Several studies have investigated the maternal and fetal outcomes of COVID-19 in pregnancy [4]. The evidence suggests pregnant women with COVID-19 are more likely to require hospitalization and intensive care unit admission than non-pregnant women with COVID-19. Additionally, pregnant women with COVID-19 may have an increased risk of preterm birth, cesarean delivery, and stillbirth compared to those without COVID-19.

Overall, short-term outcomes of infants born to mothers who developed COVID-19 during pregnancy seem favorable. Rates of transmission of SARS-CoV-2 are estimated at 1.9 per 100 pregnancies. Postnatal transmission of SARS-CoV-2 accounts for the majority of infections reported in neonates. Adverse neonatal outcomes of infants of mothers with COVID-19 disorder, such as death, have been mainly attributed to prematurity or comorbidities [5].

Material and Methods

Two hundred sixty-seven pregnant patients who had COVID-19 infection during their pregnancy from January 2020 to August 2022, with confirmed positive PCR test results, were included in our study as a patient group. Three hundred sixty-five pregnant patients who did not have COVID-19 infection during pregnancy were included.

Study Design and Population

This retrospective study included 632 pregnant women who gave birth between January 2020 and December 2022 at a single tertiary care center. Of these, 267 women were confirmed to be COVID-19 positive during pregnancy, and 365 were COVID-19 negative.

Data Collection

Data were collected from electronic medical records, including maternal demographics, medical history, pregnancy outcomes, maternal COVID-19 infection time (week of pregnancy), and neonatal outcomes. All data were collected by trained research personnel and reviewed by a senior obstetrician/gynecologist for accuracy.

Maternal and Fetal Outcomes

Maternal outcomes included hospitalization, admission to the intensive care unit, the indication of labor, type of labor, and maternal mortality. Neonatal outcomes included birth weight, birth height, Apgar scores at 1 and 5 minutes, neonatal intensive care unit admission, and neonatal mortality.

Statistical Analysis

SPSS 15.0 for Windows program was used for statistical analysis. Descriptive statistics: numbers and percentages for categorical variables, mean, standard deviation, minimum, maximum, and median for numerical variables. The rates in the groups were compared with the Chi-Square Test. Comparisons of the numerical variable between two independent groups were made using the Mann-Whitney U test since the normal distribution condition was not met. The alpha significance level was accepted as $p<0.05$.

Limitations

This study has several limitations, including its retrospective design, the possibility of selection bias, and the relatively small sample size. Additionally, the study was conducted at a single tertiary care center, which may limit the generalizability of the findings to other settings. Furthermore, COVID-19 PCR tests may give false negative results, leading to an error during the grouping of patients.

Ethical Approval

This study was approved by the Ethics Committee of Health Science University Sisli Hamidiye Etfal Research and Training Hospital (Date: 2022-10-07, No:3676).

Results

A total of 632 pregnant women were included in this retrospective study, of whom 267 were COVID-19 positive and 365 were COVID-19 negative. The mean age of the study population was 29.2 years (SD = 5.6 years), and the mean gestational age at delivery was 38.5 weeks (SD = 1.9 weeks).

Maternal outcomes

Pregnant women who had COVID-19 infection during any time of their pregnancy period were at an older age (29.9 vs. 28.7, $p<0.003$). The mean delivery week was 38.6 in the COVID-19 positive group and 38.4 in the COVID-19 negative group ($p<0.72$).

Regarding delivery mode, pregnant women with COVID-19 infection had a similar rate of cesarean section delivery (51% vs. 44.5%, $p < 0.112$) compared to the control group (Table 1).

Among 267 COVID-19-positive patients, 42 women (17%) had COVID-19 infection in the first trimester, 113 women (45.7%) had COVID-19 disease in the second trimester, and 92 women (37.2%) had COVID-19 infection in the third trimester.

Neonatal outcomes

Birth weight and birth height were similar between the two groups, with a mean birth weight of 3,277 grams (SD = 466 grams) in the COVID-19 positive group and 3,255 grams (SD = 533 grams) in the COVID-19 negative group (Table 2) and mean birth height of 49.9 cm (SD = 2.4 cm) in COVID-19 positive group and 49.8 cm (SD = 3.0 cm) in COVID-19 negative group (Table 3).

Additionally, Apgar scores at 1. minute and 5. minutes (1' 7.67 and 5' 9.19 vs. 1' 7.65 and 5' 9.17 $p < 0.88$) were also similar between the two groups. There was no neonatal mortality observed. Neonates' hospitalization duration was close, with 0.23 days vs. 0.64 days ($p<0.518$).

There is a statistically meaningful difference between birth

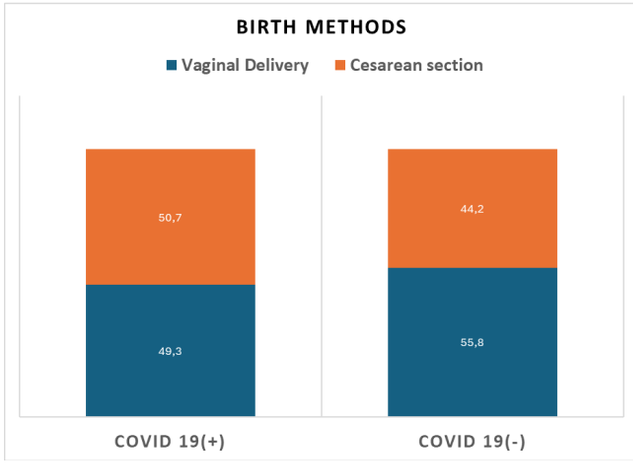

Figure 1. Delivery Methods of Women Who Had COVID-19 Infection During Pregnancy and Control Group

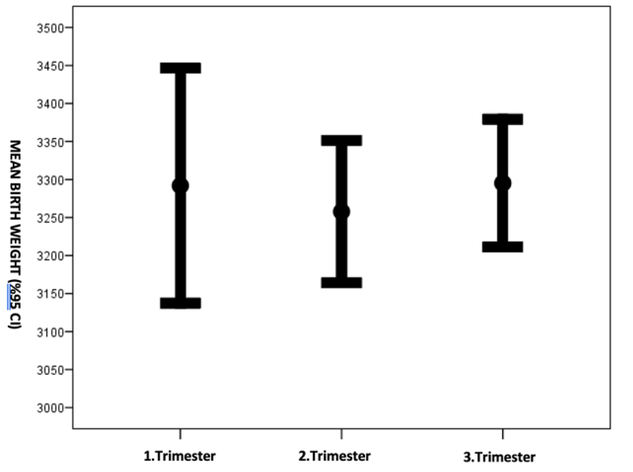

Figure 2. Mean Birth Weights According to Pregnant Women's COVID-19 Positivity Trimester

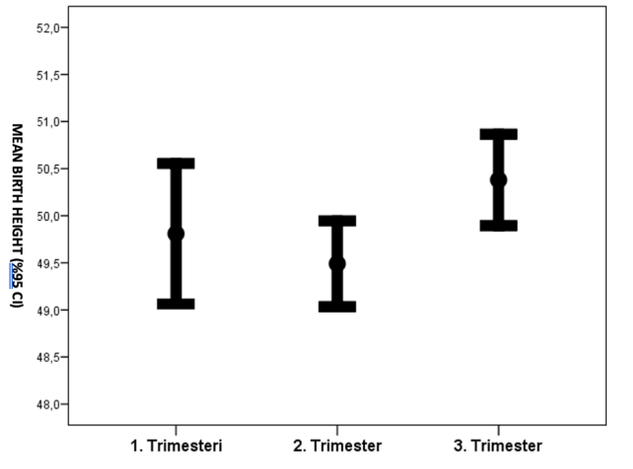

Figure 3. Mean Birth Heights According to Pregnant Women's COVID-19 Positivity Trimester

heights when we analyze pregnant women who had COVID-19 infection according to trimesters. Neonates who had been born to women who had COVID-19 infection during 2. Trimester had a mean birth height of 49.5 cm (SD=2.4) vs. 50.4 cm (SD=2.3) who had an infection during 3. Trimester ($p<0.049$). There was no statistically significant difference between birth weights.

Overall, these results suggest that women who had COVID-19 infection during pregnancy had no increased risk of low birth weight and height, preterm birth, cesarean section delivery, and low APGAR scores compared to women who had not been diagnosed with COVID-19 disease during their pregnancy period. In contrast, results also showed that neonates born to women with COVID-19 infection during the second trimester are at more risk of decreased birth height.

Discussion

The COVID-19 pandemic has affected millions of people worldwide, including pregnant women, raising concerns about the potential impact of COVID-19 on maternal and fetal health. The evidence suggests that pregnant women with COVID-19 are more likely to require hospitalization, intensive care unit admission, preterm birth, cesarean delivery, and stillbirth than pregnant women without COVID-19. Adverse neonatal outcomes of infants of mothers with COVID-19 infection have been mainly attributed to prematurity or comorbidities.

This study included 267 pregnant women with COVID-19 infection during pregnancy and 365 pregnant women who did not have COVID-19 disease during pregnancy, with a mean age of 29.2 years and a mean gestational age at delivery of 38.5 weeks. The study found that pregnant women who had COVID-19 infection during any time of their pregnancy period were older than the control group.

There are plenty of studies that show that COVID-19 infection during pregnancy may cause preterm birth. [6, 7, 9, 13, 14, 17, 18]. An important cohort study compared the outcomes of pregnant women, who underwent childbirth with versus without COVID-19 infection. It was found that pregnant women with COVID-19, compared with those without COVID-19, were more likely to have a preterm delivery. [16] In another cohort study done by the Spanish Obstetric Emergency Group, it is stated that more preterm births are observed among COVID + women but that was mainly because of the increase in iatrogenic preterm births. [12] In our study, the are no significant differences in gestational age between the two groups. Similar to our study, another cohort study took place in a large tertiary maternity unit in North West England and stated that there was no significant change in the risk of preterm delivery between COVID-19 + and COVID-19 – mothers [10].

Another conclusion in our study is that the pregnant women with COVID-19 infection during pregnancy had a similar rate of cesarean section delivery compared to the control group. Contrary to our findings, some researchers published that cesarean rates are higher in COVID-19 + patients[6, 10, 11, 12, 13, 18, 19] According to the meta-analysis of Marchand, G. et al. (2022) [7], A high rate of cesarean delivery (53.2%) was observed among pregnant women with COVID-19. In a systematic review of 104 cases, cesarean delivery was more common than normal spontaneous vaginal delivery [8].

Neonatal outcomes such as birth weight, birth height, Apgar scores, and neonatal mortality were identical between the two groups. Parallel to this study, there are several studies indicating that the birth weights of the neonates' of the two groups have no significant difference [13, 14, 17].

Conclusion

In conclusion, the COVID-19 pandemic has affected millions of people worldwide, including pregnant women.

This retrospective study included 267 pregnant patients with COVID-19 infection during pregnancy and 365 pregnant patients who did not have COVID-19 disease during pregnancy. The study found that pregnant women with COVID-19 infection during pregnancy had a similar rate of cesarean section delivery compared to the control group. The study also found no significant differences in neonatal outcomes, including birth weight, birth height, Apgar scores at 1 and 5 minutes, neonatal intensive care unit admission, and neonatal mortality, between the two groups.

Still, this research is limited because is a retrospective study, had only a small group of participants and potentially has selection biases. The study was conducted at a single tertiary care center, which may limit the generalizability of the findings to other settings. Additionally, COVID-19 PCR tests may give false negative results, leading to an error during the grouping of patients. Despite these limitations, this study provides valuable information about the outcomes of pregnant women with COVID-19 infection and their neonates.

Further research is needed to fully understand the impact of COVID-19 on maternal and fetal health during pregnancy. But still, pregnant women should be vaccinated against COVID-19 when possible, wear masks, practice social distancing, and wash their hands frequently. Healthcare providers should also continue to monitor pregnant patients with COVID-19 closely to provide appropriate care and support.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and Human Rights Statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or compareable ethical standards.

Funding: *None*

Conflict of Interest

The authors declare that there is no conflict of interest.

References

1. Wang C, Horby PW, Hayden FG, Gao GF. A novel coronavirus outbreak of global health concern. Lancet. 2020;395(10223):470-473.

2. Wastnedge EAN, Reynolds RM, van Boeckel SR, Stock SJ, Denison FC, Maybin JA, et al. Pregnancy and COVID-19. Physiol Rev. 2021;101(1):303-318.

3. Wang CL, Liu YY, Wu CH, Wang CY, Wang CH, Long CY. Impact of COVID-19 on pregnancy. Int J Med Sci. 2021;18(3):763-767.

4. Wei SQ, Bilodeau-Bertrand M, Liu S, Auger N. The impact of COVID-19 on pregnancy outcomes: A systematic review and meta-analysis. CMAJ. 2021;193(16):E540-E548.

5. Ryan L, Plötz FB, van den Hoogen A, Latour JM, Degtyareva M, Keuning M, et al. Neonates and COVID-19: State of the art: Neonatal Sepsis series. Pediatr Res. 2022;91(2):432-439.

6. Elsaddig M, ۞ Khalil A. Effects of the COVID pandemic on pregnancy outcomes. Best Pract Res Clin Obstet Gynaecol. 2021;73:125–136.

7. Marchand G, Patil AS, Masoud AT, Ware K, King A, Ruther S, et al. Systematic review and meta-analysis of COVID-19 maternal and neonatal clinical features and pregnancy outcomes up to June 3, 2021. AJOG Glob Rep. 2022;2(1):100049.

8. Abou Ghayda R, Li H, Lee KH, Lee HW, Hong SH, Kwak M, et al. COVID-19 and adverse pregnancy outcome: A systematic review of 104 cases. Journal of Clinical Medicine. 2020;9(11):3441.

9. Ko JY, DeSisto CL, Simeone RM, Ellington S, Galang RR, Oduyebo T, et al. Adverse pregnancy outcomes, maternal complications, and severe illness among us delivery hospitalizations with and without a coronavirus disease 2019 (covid-19) diagnosis. Clin Infect Dis. 2021;73(Suppl 1):S24-S31.

10. Wilkinson M, Johnstone ED, Simcox LE, Myers JE. The impact of COVID-19 on pregnancy outcomes in a diverse cohort in England. Sci Rep. 2022;12:942.

11. 11. Karaçam Z, Kizilca-Çakaloz D, Güneş-Öztürk G, Çoban A. Maternal and perinatal outcomes of pregnancy associated with COVID-19: Systematic review and meta-analysis. Eur J Midwifery. 2022;6:42.

12. Cruz Melguizo S, de la Cruz Conty ML, Carmona Payán P, Abascal-Saiz A, Pintando Recarte P, González Rodríguez L, et al. Pregnancy outcomes and SARS-CoV-2 infection: The spanish obstetric emergency group study. Viruses. 2021;13(5):853.

13. Taghavi SA, Heidari S, Jahanfar S, Amirjani S, Aji-ramkani Amireh, Azizi-Kutenaee M, et al. Obstetric, maternal, and neonatal outcomes in COVID-19 compared to healthy pregnant women in Iran: A retrospective, case-control study. Middle East Fertil Soc J. 2021;26(1):17.

14. Milln J, Heard S, Gunganah K, Velauthar L, Saeed F. Clinical characteristics and pregnancy outcomes of women diagnosed with SARS-CoV-2 in London's most ethnically diverse borough: A cross-sectional study. Obstet Med. 2021;14(3):164–169.

15. Gupta P, Kumar S, Sharma SS. SARS-CoV-2 prevalence and maternal-perinatal outcomes among pregnant women admitted for delivery: Experience from COVID-19-dedicated maternity hospital in Jammu, Jammu and Kashmir (India). J Med Virol. 2021;93(9):5505–5514.

16. Chinn J, Sedighim S, Kirby KA, Hohmann S, Hameed AB, Jolley J, et al. Characteristics and outcomes of women with COVID-19 giving birth at US academic centers during the COVID-19 pandemic. JAMA Netw Open. 2021;4(8):e2120456.

17. Abedzadeh-Kalahroudi M, Sehat M, Vahedpour Z, Talebian P. Maternal and neonatal outcomes of pregnant patients with COVID-19: A prospective cohort study. Int J Gynaecol Obstet. 2021;153(3):449–456.

18. Gabriel MAM, Vergeli MR, Carbonero SC, Sole L, Molina TC, Calle IR. Maternal, perinatal and neonatal outcomes with COVID-19: A multicenter study of 242 pregnancies and their 248 infant newborns during their first month of life. Pediatr Infect Dis J. 2020;39(12):e393–e397.

How to cite this article:

Narin Ece Çakmak, Burak Çakmak, Gül Özel Doğan, Alev Atış Aydın. *Maternal and fetal outcomes of COVID-19 infection: A retrospective study from Istanbul, Turkey. Ann Clin Anal Med 2024;15(7):449-452*

This study was approved by the Ethics Committee of Health Science University Sisli Hamidiye Etfal Research and Training Hospital (Date: 2022-10-07, No:3676)